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AUTHORITY

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[redacted]

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[redacted]

Attn: SKSD

[redacted]

CONVAIR (ASTRONAUTICS) DIVISION
GENERAL DYNAMICS CORPORATION

[redacted]

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CONVAIR ASTRONAUTICS

CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION

SEP 20 '61

FUNCTIONAL TEST OF LIQUID OXYGEN

TANKING UNIT 7-29207-3

(MODEL 5141) S/N AA-9A

REPORT NUMBER 27B1230-1

PREPARED BY S. Tocot

CHECKED BY L. R. Jordan

Checked by F. Wallace, Jr.,
Asst. Test Lab Group Engr.

APPROVED BY W. O. Berry
Test Lab Group Engr.

APPROVED BY R. S. Campbell
Chief of Test Labs

REVISIONS

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GLOSSARY OF ABBREVIATIONS

GPM = Gallons per minute

PSIG = Gauge pressure in pounds per square inch

°F = Temperature in degrees Fahrenheit

LO_2 = Liquid oxygen

PCS = Performance check sheet

LA = LO_2 Pump A

LB = LO_2 Pump B

LC = LO_2 Pump C

INTRODUCTION:

Due to the disassembly and rework of the Oxidizer Tanking Unit (S/N AA-9A), it was deemed necessary to perform a functional checkout of the unit after reassembly.

OBJECT:

The object of this test is to conduct a functional checkout of the Liquid Oxygen Tanking Unit (S/N AA-9A) and see that it meets the specifications as set forth on Pages 11, 12, and 13 of the PCS 342-A.

These specifications include the following: Pump LC shall pump at a minimum rate of 10 gpm against a head pressure of 14 to 36 psig depending on the external throttle valve position and pump speed. Pump LC shall pump at least at a rate of 250 gpm against a head pressure of 18 to 40 psig depending on the external throttle valve position and pump speed. Pumps LA and LB shall pump at a minimum rate of 500 gpm each against a head pressure of 70 psig.

CONCLUSION:

The unit performed satisfactorily and met the specifications set forth in the PCS.

RECOMMENDATIONS:

1. It is recommended that components disassembled or removed during rework of future tanking units undergo bench checks prior to installation.

2. JM-76 Gasket Material should be used in place of Teflon wherever possible.

TEST PROCEDURE:

For the test procedure refer to the PCS and the Systems Test Labs standard procedure for operating the Liquid Oxygen Tanking Unit at Point Loma Test Site.

RESULTS:

During checkout and leak check of the unit many problem areas arose. Several pressure regulators were found to be defective during the pressurization of the pneumatic system. Upon further investigation it was found that at least one of these regulators was installed backward. Also, several of the swage lock fittings leaked and had to be replaced.

Valve LB-3 (reference Figure 1) did not function correctly on initial checkout. It was determined that a faulty cylinder seal was the cause. The solenoid for Valve LB-2 leaked around the seat and had to be replaced. Valve LC-1 was assembled improperly and required rework.

The valve position potentiometer on this valve was installed incorrectly and the limit switch circuit had to be rewired.

During leak checks it was discovered that 4 flange seals leaked badly. It was recommended that the Teflon gasket material in these flanges be replaced with JM-76. The recommendation was accepted and the gaskets were replaced. A leak check was then performed and the unit was found to be leak free.

Typical curves of flow rates, inlet pressures and temperatures, and outlet pressures and temperatures are shown in Figures 2, 3, 4, and 5.

The first run was made with Pump LC only. The flowmeter at the exit of Pump LC malfunctioned early in the test and accurate flowrate data could not be taken. However, the flowrate was approximately determined by monitoring the liquid level of the tank into which the pump was circulating. The following values were obtained during this run: Flowrate = 250 GPM, Inlet Pressure = 13.5 psig, Inlet Temperature = -293.2°F, Pump LC Outlet Pressure = 23.5 psig, Unit Outlet Pressure = 14 psig, and Unit Outlet Temperature = -292.5°F.

The next run was made with Pumps LA, LB, and LC all running. Some trouble was encountered keeping the pumps primed so the storage tank pressure was raised to 35 psig. The following steady state conditions were reached: Flowrates 1320 GPM, Inlet Pressure = 20.5 psig, Inlet Temperature = -292.7°F, Pump LC Outlet Pressure = 66.5 psig, Unit Outlet Pressure = 52 psig, Unit Outlet Temperature = -291.5°F.

RESULTS: (Continued)

The tanking unit was set up for back flow and Pump LC was turned on. After approximately seven minutes of run time the drive belt in the Varidrive unit of Pump LC failed and the pump was shut down. Detanking was continued pneumatically. The steady state conditions attained while Pump LC was operating were the following: Inlet pressure 16.2 psig, Inlet temperature = -284.7°F, Pump LC outlet pressure = 44 psig, Unit outlet pressure = 36 psig, Unit outlet temperature = -284.5°F. For this run the inlet of the tanking unit is actually on the outlet side of Pump LC and vice versa.

A final run was made with Pumps LA and LB both running. The steady state values obtained were: Flowrate 1025 gpm, Inlet pressure = 18.4 psig, Inlet temperature = -291.5°F, Unit outlet pressure = 58.5 psig, and Unit outlet temperature = -290°F.

NOTE: The test data from which this report was prepared are recorded in Engineering Test Laboratories Data Book Number 7292.

LO_2 TANKING UNIT TEST SCHEMATIC

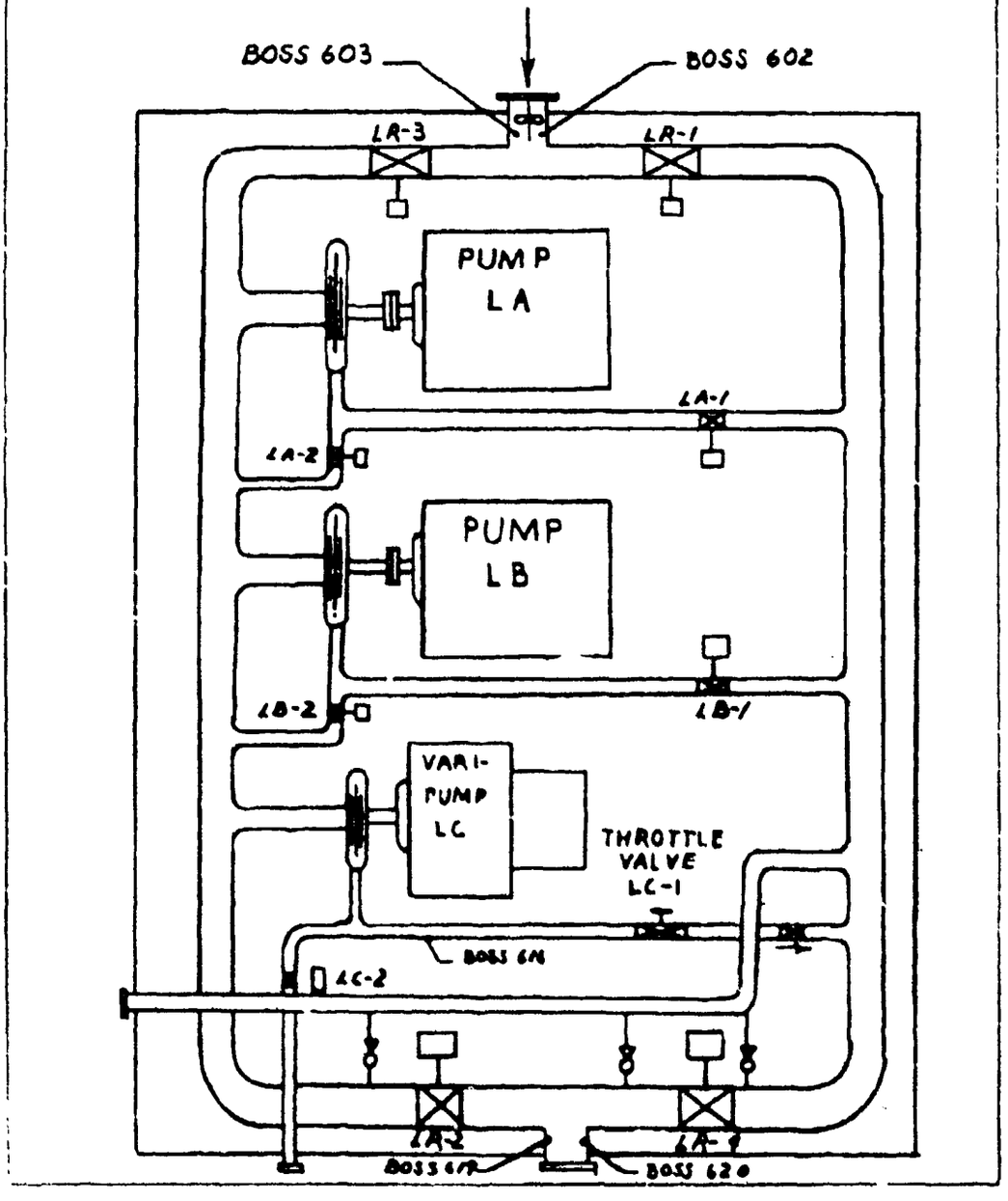

FIGURE 1
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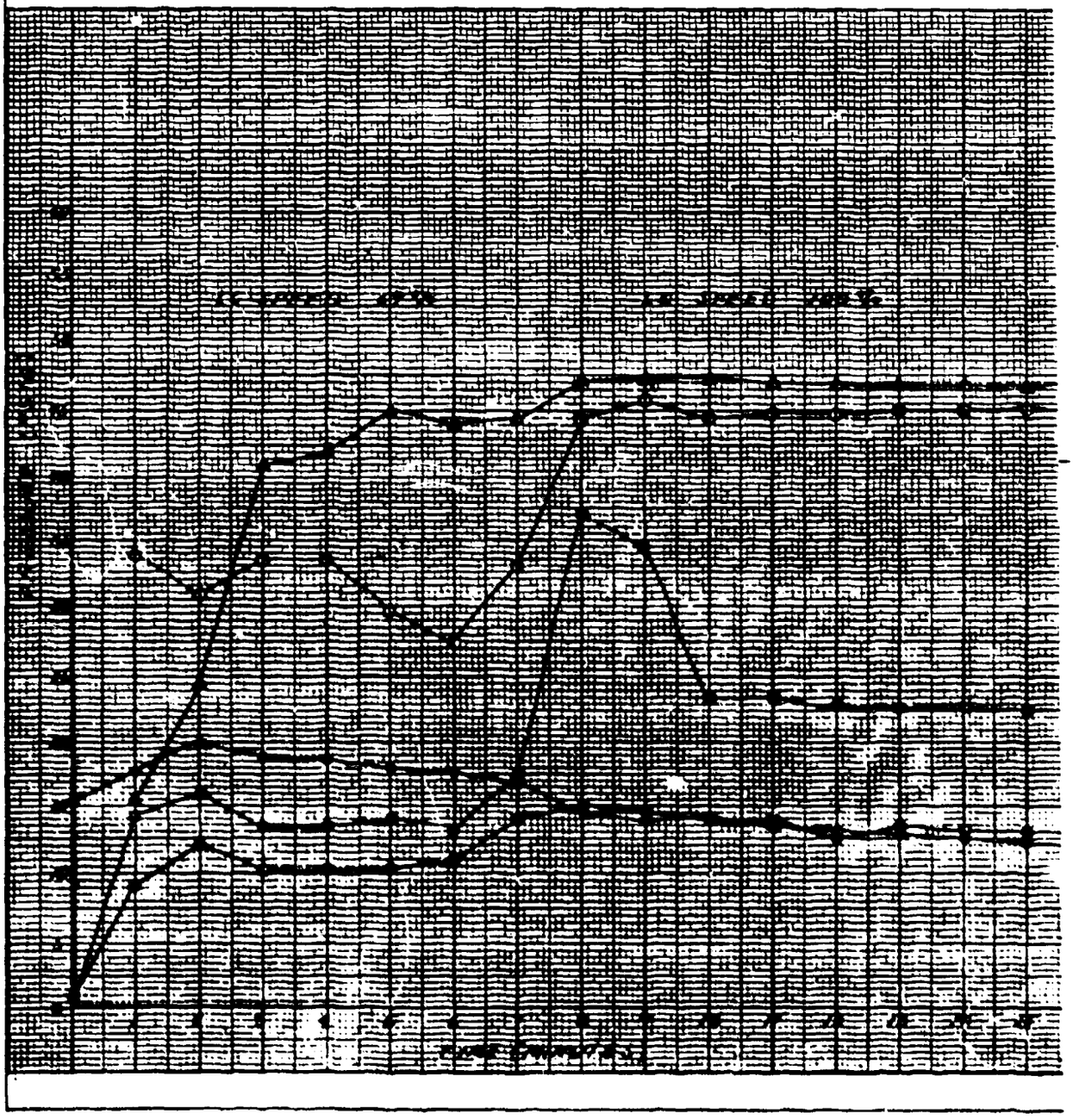
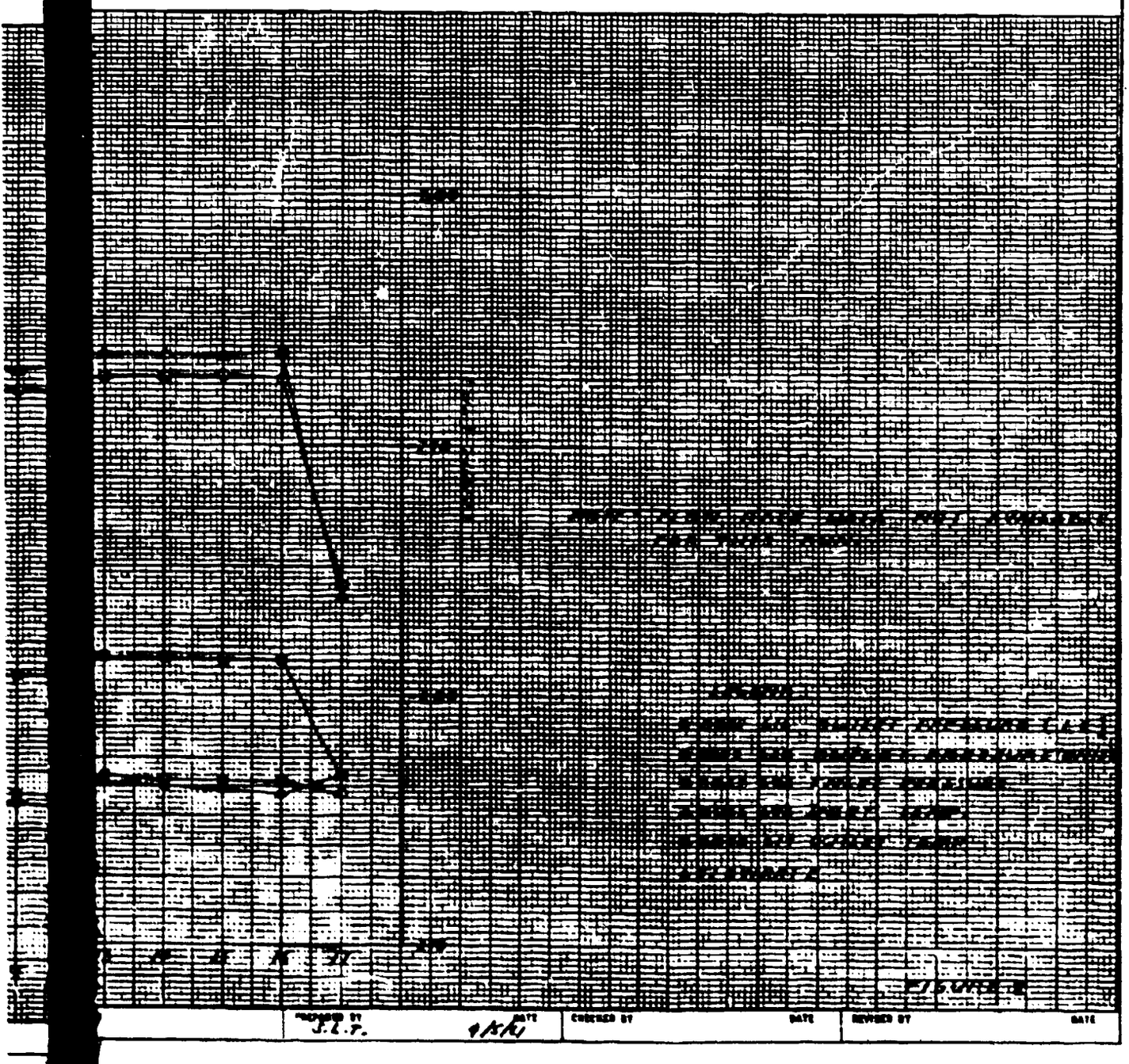
PERFORMANCE CHARACTERISTICS OF LO_2 TANKING UNIT AA-9



UNIT AA-9A, PUMP LC ON AND TANKING



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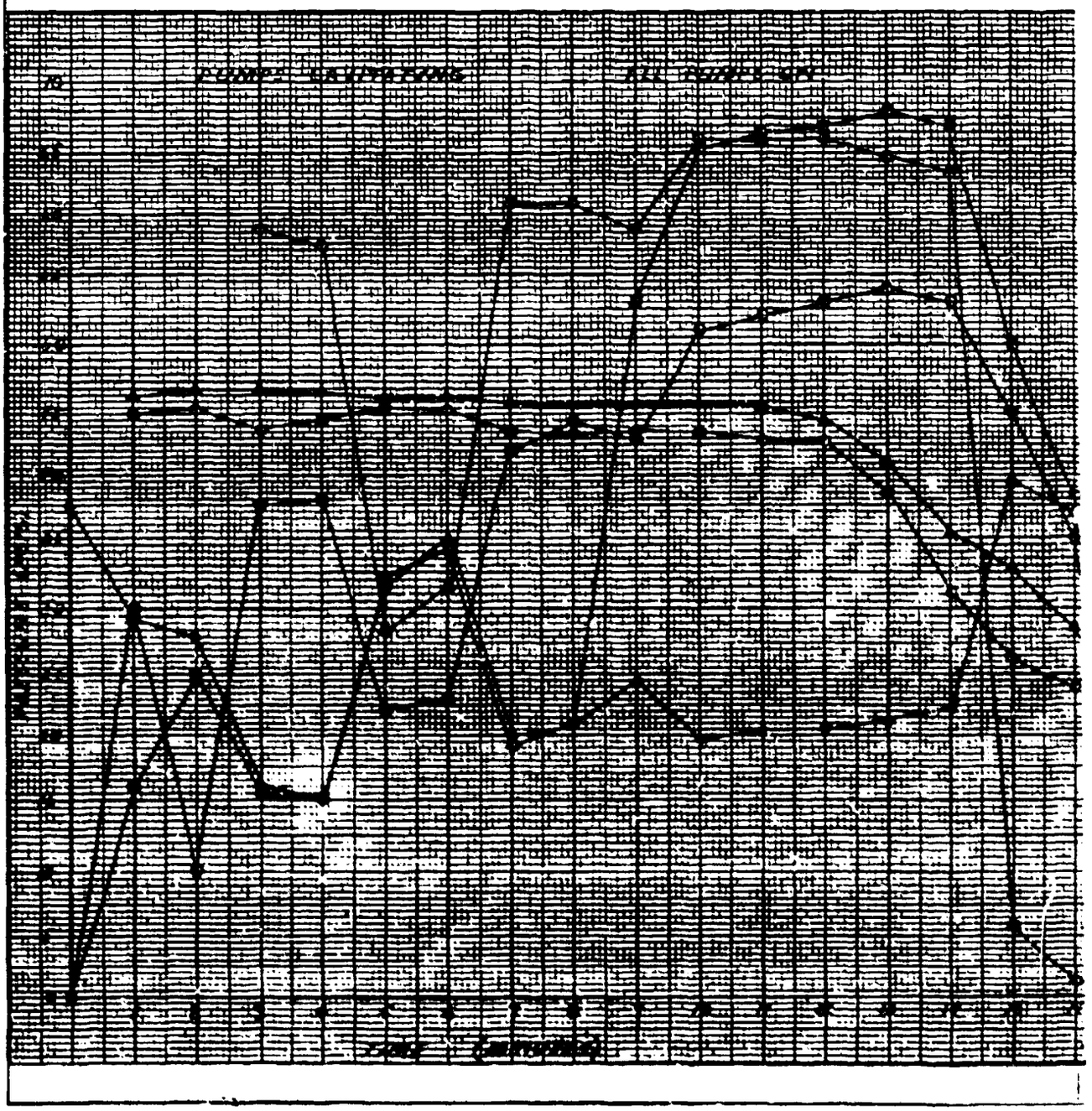
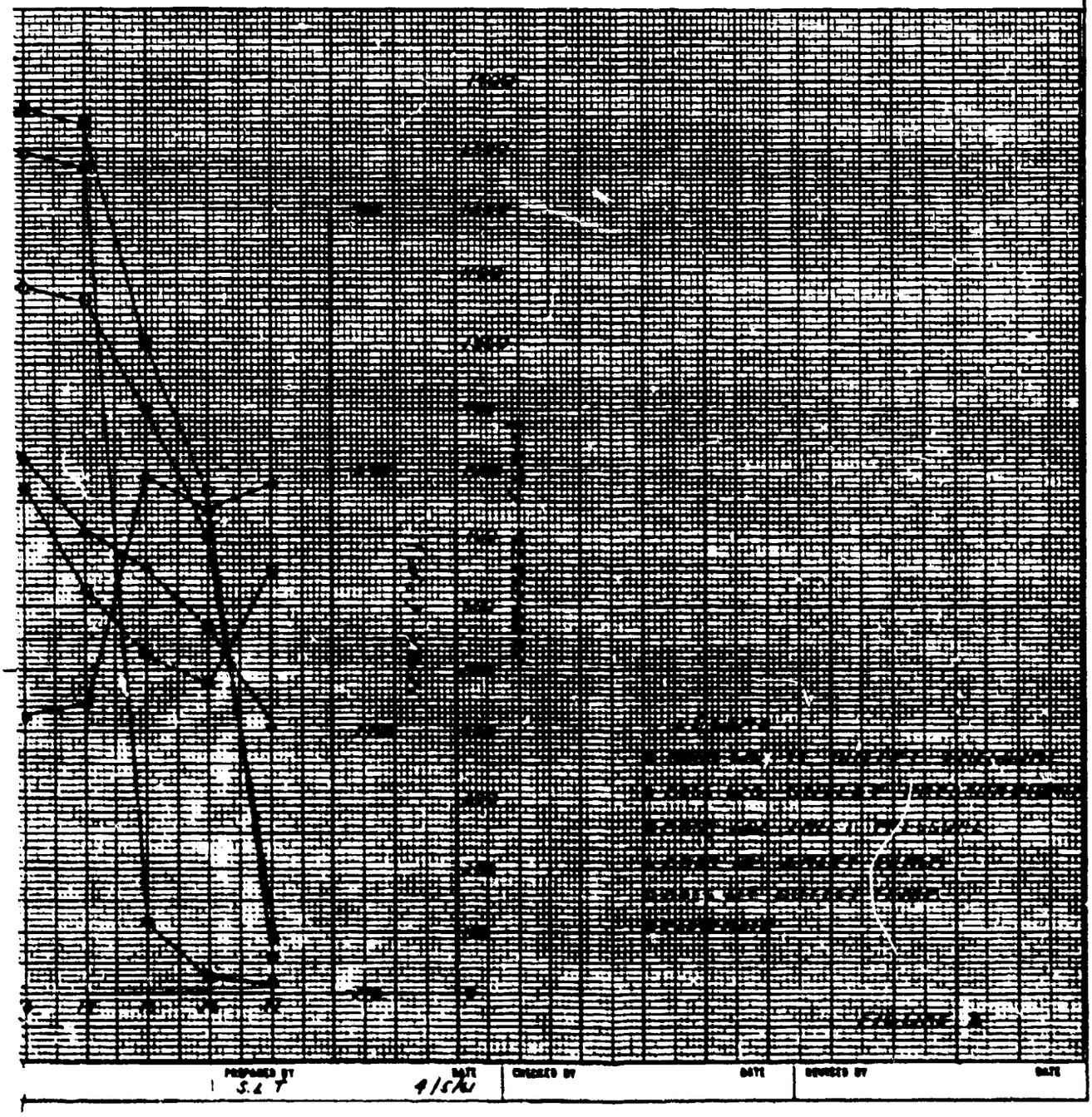
PERFORMANCE CHARACTERISTICS OF LO_2 TANKING UNIT AA-9A, PUMP



AA-9A, PUMPS LA, LB, & LC ON AND TANKING



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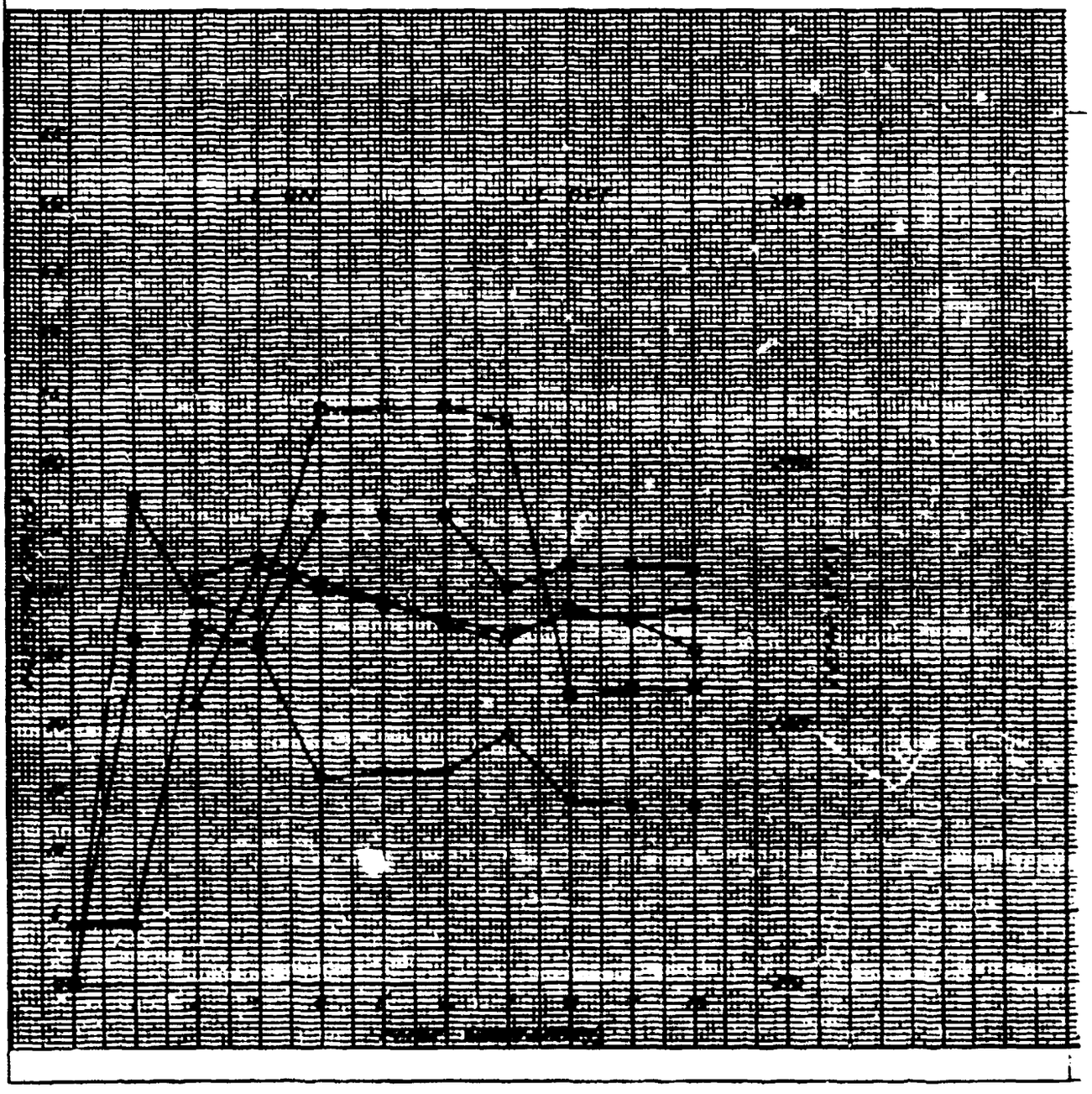
PERFORMANCE CHARACTERISTICS OF LO_2 TANKING UNIT AA-9A, PUMP L



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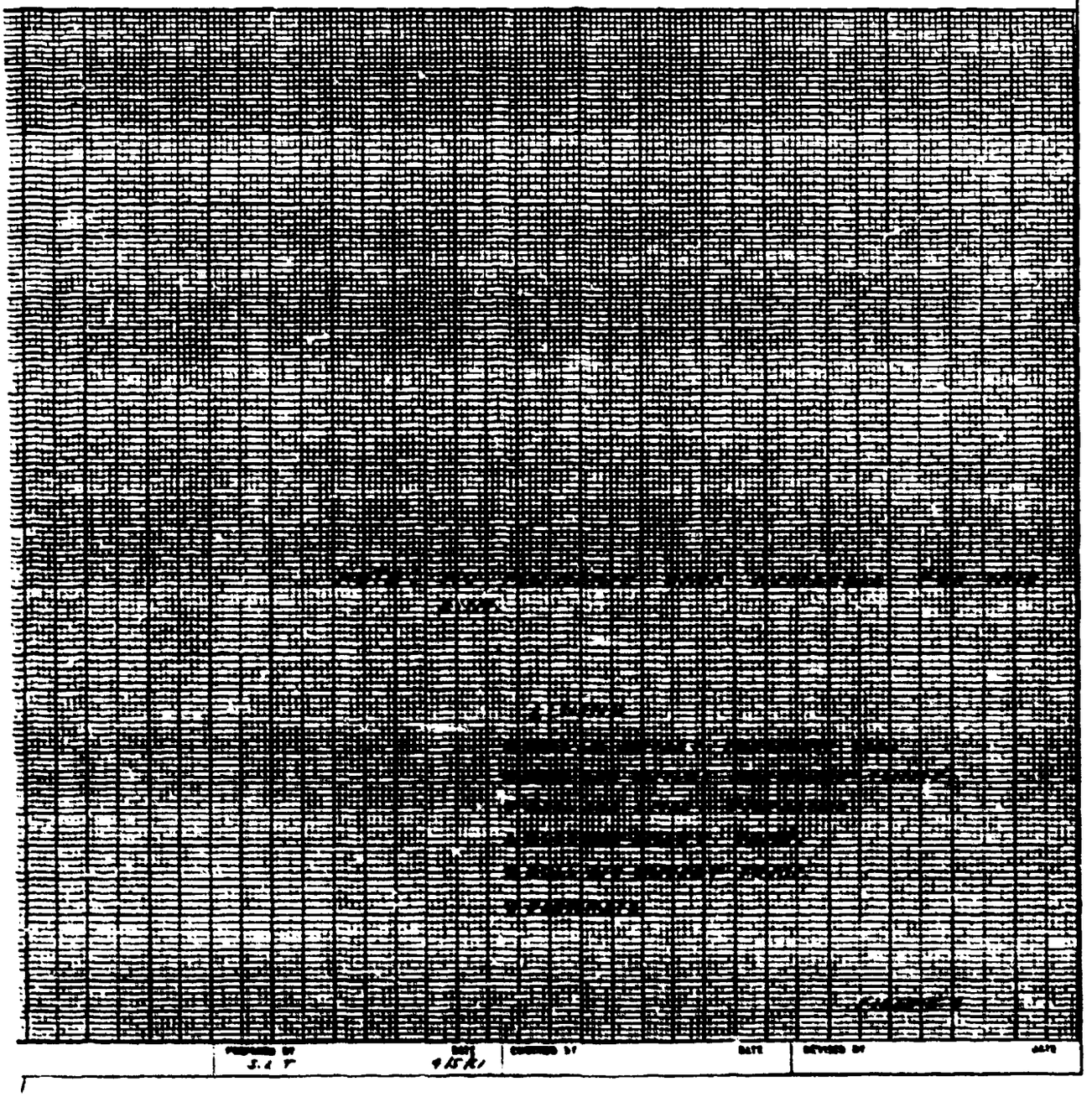
FORM NO. 1757-2

AA-9A, PUMP LC ON AND DETANKING



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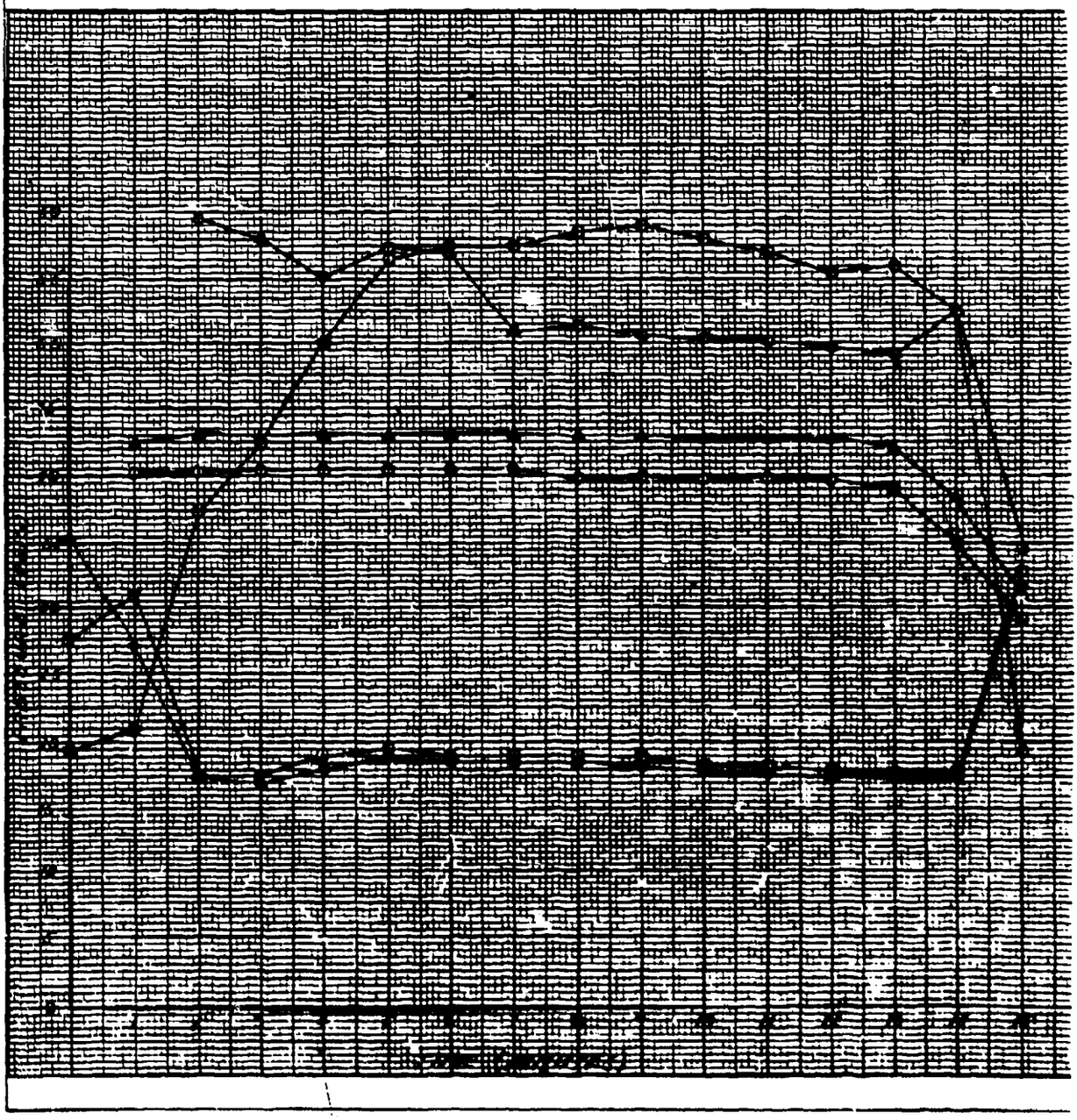
PERFORMANCE CHARACTERISTICS OF LO_2 TANKING UNIT AA-9.



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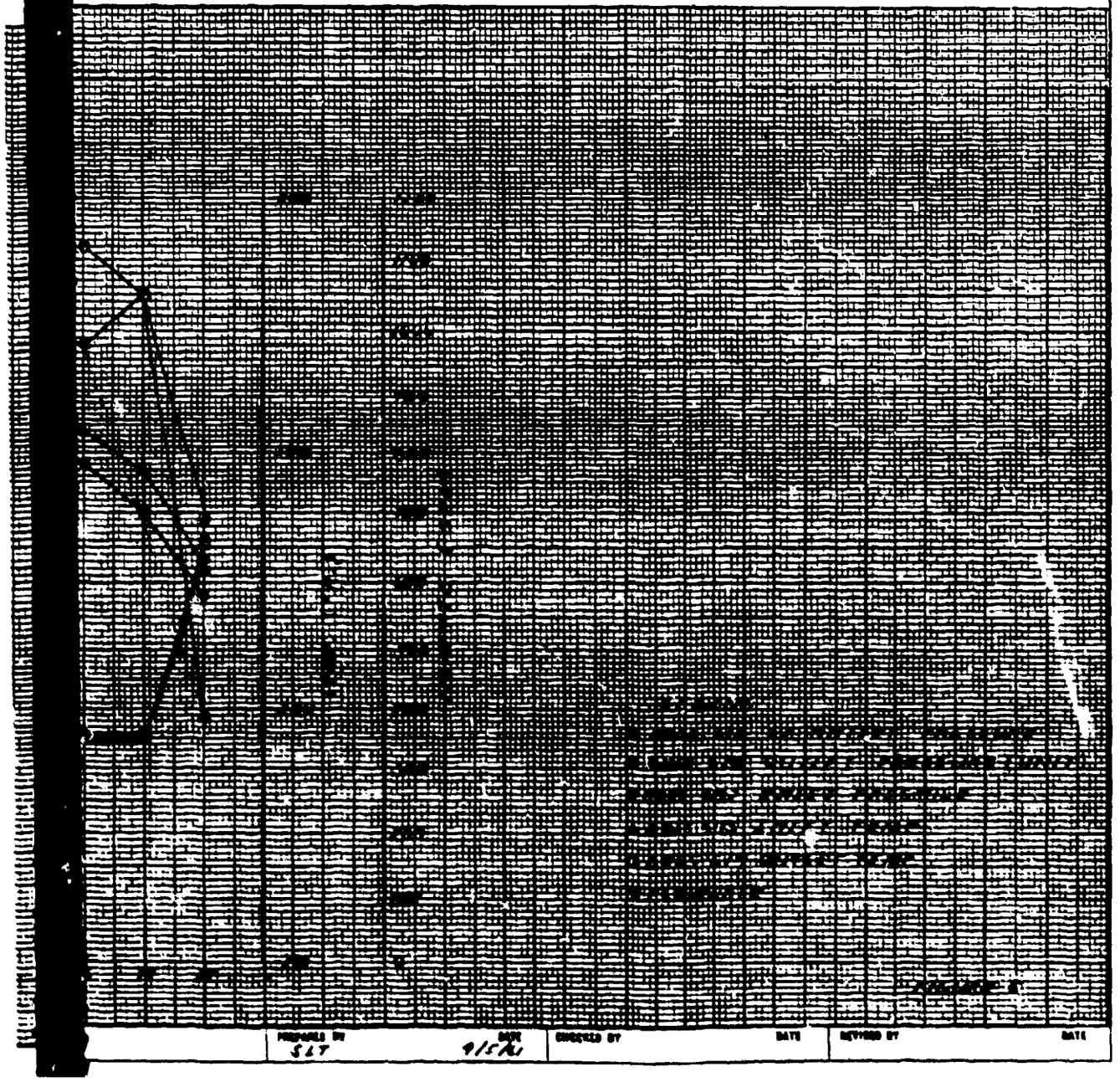
FORM NO. A707-2

UNIT AA-9A, PUMPS LA & LB ON AND TANKING



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